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REPORT

of the

Army Ground Forces Board No. 3

FORT BENNING, GEORGIA

Project No. 1919

SIEG COMPENSATOR FOR BAR

Date 6 Dec. 1945

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R/T 1919

474.8 (18 Jul 45)
GNDEV-11/46397 4th Ind.

HEADQUARTERS ARMY GROUND FORCES, Washington 25, D. C., 17 December 1945

TO: Commanding General, Army Service Forces. ATTENTION: Research and Development Division, Room 4E 633, The Pentagon

1. Herewith report of test of Sieg Compensator for Browning Automatic Rifle conducted by Army Ground Forces Board No. 3.

2. As can be noted in the subject report, it is concluded that a requirement exists for a compensator or similar device for the Browning Automatic Rifle, but that the subject Sieg device is not satisfactory in that it does not reduce flash or blast.

3. Therefore, the recommendations of the Board, that the subject compensator not be adopted in its present form and that a compensator for the Browning Automatic Rifle be developed incorporating the following features, are approved:

a. Decrease recoil and increase stability of the Browning Automatic Rifle.

b. Incorporate flash-hiding properties.

c. Produce minimum dust.

d. Produce minimum blast on the gunner.

e. Be easily removable in the field and to permit ready cleaning of the gas cylinder and piston.

4. It is requested that after development has been made of the new device, four (4) models be furnished Army Ground Forces Board No. 3 for test and this headquarters be notified of the date of shipment in order that a directive can be submitted to the board.

FOR THE COMMANDING GENERAL:

S. R. KNIGHT
Lt. Col., A. G. D.
Asst. Ground Adj. Gen.

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ARMY GROUND FORCES BOARD NO. 3
Fort Benning, Georgia

6 December 1945

SUBJECT: Sieg Compensator for BAR

TO: The Commanding General, Army Ground Forces
Washington 25, D. C.

1. Project: BAR with Sieg Compensator.

a. (1) Authority: 1st Indorsement, Headquarters, Army Ground Forces, GNRQT-11/35524, 27 July 1945.

(2) References:

Reports of Test, The Infantry Board:

No. 462, "Recoil Reducers, Compensators, Flash Hiders and .50 Caliber Bolt Return Accelerator"

No. 655, "Modified Flash Hiders for Browning Automatic Rifle"

No. 1675-E, "Flash Hiders (Flash Hiders-Silencers) for U.S. Carbine, Caliber .30, M1"

No. 1819, "Rifle, Caliber .30, T20E1"

No. 1835, "Recoil Checks, T12 and T13, for Carbine, Caliber .30, M2"

b. Purpose: Tests were conducted to determine the effect of subject compensator on the firing, accuracy and functioning of the BAR.

2. Discussion:

a. Description of Material:

(1) Subject device is designed to increase stability of the Browning Automatic Rifle. It is fastened to a modified BAR around the barrel, between the front end of the gas cylinder and the rear side of the front sight.

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(2) The BAR barrel has twenty-six holes drilled in it between the gas cylinder tube bracket and the front sight. Around this section of the barrel is fitted a cylindrical split sleeve, made up of two similar halves. Radial holes are drilled in the split sleeve, while annular rings are provided on the outside of the sleeve.

(3) An outer cylindrical jacket covers the split sleeve. This jacket has 6 lateral slots cut in the top and 6 holes drilled in the right side.

(4) A rear collar fits against the gas cylinder tube bracket and a front collar fits against the front sight base, to hold the assembly in position.

b. Details of Tests:

(1) Cyclic rate (fast rate) of subject BAR is approximately the same as the cyclic rate of a comparison standard BAR. Subject weapon is not equipped with a rate reducer. It does not appear probable that subject compensator will have any material effect on cyclic rate. (Test No. 1, Inc. 3)

(2) The subject weapon produces more flash than the standard BAR with flash hider or without flash hider. (Test No. 2, Inc. 3)

(3) There is no material difference in muzzle blast or in the dust clouds produced by the subject BAR and by a standard BAR. Some of the blast and smoke from subject weapon is distributed vertically, instead of ahead of the gun, as with the standard BAR. (Test No. 3, Inc. 3)

(4) No material difference in report noise between the subject and standard BAR was noted at ranges of 10 yards, 200 yards and 500 yards from the gun. (Test No. 4, Inc. 3)

(5) Comparative accuracy figures for various types of fire and including ranges of 1000 inches, 200 yards and 300 yards, are listed below:

(a) Single Shot:

Group Size (inches) - Average of all Ranges

	Horizontal		Vertical		100% Zone Maximum	
Position	BAR with comp.	BAR w/o comp.	BAR with comp.	BAR w/o comp.	BAR with comp.	BAR w/o comp.
Prone with bipod	6.2	6.2	5.7	7.2	10.5	12.3
Sitting and kneeling combined	8.5	8.4	9.5	9.5	17.1	17.5

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These figures indicate little difference in accuracy between the BAR with Sieg Compensator and the standard BAR.

(b) Full Automatic 10-Round Bursts:

Group Size (inches) - Average of all Ranges

Position	Horizontal		Vertical		100% Zone Maximum	
	BAR with comp.	BAR w/o comp.	BAR with comp.	BAR w/o comp.	BAR with comp.	BAR w/o comp.
Prone with bipod	7.3	11.9	6.0	9.1	12.1	20.4

Study of these figures indicates that the BAR with Sieg Compensator produces groups materially smaller than the standard BAR. Groups with the standard BAR averaged approximately 50% to 70% larger than groups fired with subject weapon. (Test No. 5, Inc. 3)

(6) The effect of the Sieg Compensator is to reduce recoil and to eliminate the tendency of the muzzle to move upward and to the right during automatic fire. (Test No. 5, Inc. 3)

(7) Subject compensator has no apparent effect on functioning of the BAR. The compensator would not permit removing the gas cylinder tube for thorough cleaning, which made it necessary to operate the weapon on the large gas port throughout the test. (Test Nos. 6 and 7, Inc. 3)

(8) When the compensator was removed, it was found that one ring of the inner sleeve had broken off. It is not known when this ring broke. No other damage to the compensator was noted during the test. (Test No. 7, Inc. 3)

(9) The bipod may be used in conjunction with the compensator, since the bipod mounts ahead of the front sight while the compensator mounts behind the front sight. (Test No. 7, Inc. 3)

(10) The BAR with compensator gives much less recoil than the standard BAR. This should result in less fatigue due to firing and is probably a large contributing factor to the increased accuracy shown in automatic fire. (See Par. (5), above.)

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c. Comments on Tests:

(1) Army Ground Forces Board No. 3 and its predecessor, The Infantry Board, have conducted a number of tests of muzzle checks, compensators and similar devices on shoulder-fired automatic arms. In general, the conclusions drawn each time have been about the same--that the devices do increase stability, decrease recoil and result in an increased number of hits in automatic fire.

(2) In Report of Test No. 462, The Infantry Board said:

"3. d. Browning Automatic Rifle (M1918): The only weapon which showed a definite improvement when compensated was the Browning Automatic Rifle. This improvement consisted mainly in the fact that the firer was able to greatly increase his percentage of hits at full automatic fire. The action of the compensators is very disagreeable, producing considerable blast and raising a cloud of dust which reduces accuracy due to poor visibility. Much of the advantage is therefore lost. Added difficulties of cleaning and caring for the rifle are undesirable. The improvements in functioning or accuracy at slow and semiautomatic fire are negligible or greatly discounted by the disadvantageous features. The Board concludes that the Browning Automatic Rifle offers the best field for application of the recoil check.

"4. The Board finally concludes that none of the recoil checks or devices submitted are suitable in present form; that the advantage of a recoil checking device is apparent to the greatest extent when adapted to the Browning Automatic Rifle at full automatic fire; that of the devices submitted the Cutts compensator was the most effective; that a recoil check which will enable the automatic rifleman to fire his weapon at full automatic fire with a satisfactory degree of efficiency would be of assistance in determining the possibilities of full use of the Browning Automatic Rifle.

"5. It is recommended that none of the devices submitted be adopted, but that experiments be continued in the effort to produce a check for the Browning Automatic Rifle which will be without the defects noted in the accompanying report."

(3) In a more recent report, No. 1835, dealing with recoil checks for the carbine, The Infantry Board said:

"4. Factual Background.

The subject devices called "recoil checks" belong

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to a class of devices sometimes called compensators, muzzle brakes, etc. A compensator is defined in TM 20-205 as: "Any device used to offset or allow for undesirable forces or motions. Compensators are often mounted on some types of shotguns and automatic weapons to hold down the muzzle rise and reduce recoil." A requirement exists for devices for holding down the muzzle and reducing recoil for certain classes of military weapons*********"

"6. Discussion.

a. Correctly designed devices such as recoil checks, compensators, muzzle brakes or similar devices, otherwise named, that control undesirable movement of non-automatic and automatic firearms serve a very useful purpose and are highly desirable for certain types of weapons. Numerous devices of this nature have been and are being used. The commercial so called "Compensator" appeared on the Thompson Submachine Gun and other weapons. They definitely have a place and judging from periodic suggestions from commercial agencies and from the service itself these devices appear to be a fertile field for research and suggestion. The principle of operation seems to be the same and methods of approach similar. What is desired, naturally, is to have the most simple device to accomplish the immediate requirement. "What is desired" to accomplish the immediate requirement may not be the ultimate solution desired. Factors other than just the elementary requirement for adequate weapon stability enter the project*******"

(4) Report of Test No. 1675-B says, Paragraph 6:

"*******The question of 'compensators' or 'recoil checks' presents itself. Other than the BAR, both the M1 Rifle and the carbine are being constructed with selective semiautomatic and full automatic features. A requirement exists for an effective recoil check especially for the BAR, M1 Rifle and Carbine. *******A highly desirable combination is a flash hider and recoil check if such combination can be constructed without sacrificing too many of the desirable qualities of the individual structures."

(5) (a) Data presented in the present report does not contradict the data presented in previous reports. Results indicate that subject compensator does stabilize the gun, giving less dispersion in automatic fire and giving less recoil. Subject compensator did not appear to present the objectionable blast noted with some other types. Subject compensator does have the serious disadvantage of not permitting ready removal of certain parts of the BAR for cleaning. It also requires drilling a number of holes in the barrel as well as attaching the collars, which are Ordnance modifications.

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(b) In its present form subject compensator is not satisfactory for ground force use, but it appears to have desirable features, notably the relatively small increase in blast on the gunner.

3. Conclusions: Army Ground Forces Board No. 3 concludes that:

a. A requirement exists for a compensator or similar device on the Browning Automatic Rifle.

b. Subject compensator increases stability and decreases full automatic dispersion and recoil of the Browning Automatic Rifle.

c. Subject compensator in its present form is not satisfactory.

d. Further development of a suitable compensator for the Browning Automatic Rifle should be conducted. Such compensator should include the following features:

(1) Decrease recoil and increase stability of the Browning Automatic Rifle.

(2) Incorporate flash-hiding properties.

(3) Produce minimum dust.

(4) Produce minimum blast on the gunner.

4. Recommendations: Army Ground Forces Board No. 3 recommends that:

a. Subject compensator not be adopted in its present form.

b. A compensator for the Browning Automatic Rifle be developed, incorporating features indicated in Paragraph 3d above.

HARIAN N. HARTNESS
Brigadier General, USA
President

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INCLOSURES FOR REPORT
ON

SIEG COMPENSATOR FOR BAR

PREPARED BY

TEST SECTION
ARMY GROUND FORCES BOARD NO. 3

ROBERT P. BROWN,
Captain, Infantry,
TEST OFFICER

APPROVED:

EDWARD B. CROSSMAN,
Lt. Colonel, Infantry,
EXECUTIVE, TEST SECTION

INCLOSURES:

- #1—Authority and Correspondence
- #2—Characteristic Sheet
- #3—Details of Test
- #4—Deficiencies and Modifications
- #5—Illustrations

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Inclosure No. 1: Directive and Correspondence.

Inclosure No. 2: Characteristics.

Inclosure No. 3: Details of Tests.

Test No. 1: Effect of the subject compensator on the cyclic rate.

Test No. 2: Amount of flash caused by the Sieg Compensator on a BAR.

Test No. 3: Comparative amount and distribution of the muzzle blast and smoke resulting from BAR's fired with and without the subject compensator.

Test No. 4: Comparative difference in report noise made by a BAR equipped with Sieg Compensator and a standard BAR.

Test No. 5: Effect of the subject compensator on the accuracy and stability of the gun fired in prescribed positions.

Test No. 6: Effect of the compensator on functioning of the rifle.

Test No. 7: Ease of cleaning, durability, adaptability to the bipod, and recoil effect of the subject compensator on a BAR.

Inclosure No. 4: Deficiencies and Modifications.

Inclosure No. 5: Illustrations.

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Inclosure No. 2 - Characteristics.

1. A device known as the Sieg Compensator for use with a BAR, was submitted for test. The position of this compensator on the BAR was in front of the gas cylinder tube bracket and in rear of the front sight. (See Figures 1, 2, and 3 of Inclosure No. 5)

This compensator was composed of the following parts:

(a) A jacket or outer shell made of steel that had 6 slots or ports cut perpendicular to the axis of the bore and six small holes on the right side of the jacket.

(b) A split-ring sleeve made of steel that consisted of two similar parts fitting inside the jacket and around the outside of the barrel. The sleeve was provided with six rings and twenty four holes.

(c) A rear collar made of steel that kept the split-ring sleeve and jacket from sliding to the rear on the barrel.

(See Figures 5 and 6 of Inclosure No. 5 for dimensions and weights of the three components.)

The barrel of the BAR had twenty six escape holes in it at the location of the split-ring sleeve. (See Figure 6 of Inclosure No. 5)

2. Following are the measurements and weights:

Item	Overall dimensions in Inches Length	Diameter	Thickness	Weight in pounds
Jacket	3.22	1.25	0.13	0.30
Split-Ring Sleeve	3.47	1.13	0.50	0.26
Rear Collar	1.34	Remaining dimensions and weight unknown as the collar could not be removed from the gun barrel.		

Inclosure 3, Details of Test:

Test No. 1

a. Purpose: To determine the effect of the subject compensator on the cyclic rate.

b. Method: The rate of fire of a BAR equipped with the subject compensator and of a standard BAR was timed for firing five magazines in each at the normal (fast) cyclic rate.

c. Results:

(1) The cyclic rate varied very little between a BAR with the subject compensator and a standard BAR.

(2) Following are the tabulated results:

Magazine No.	BAR with Sieg Compensator	Standard BAR
1	2.4 sec.	2.2 sec.
2	2.3 "	2.1 "
3	2.2 "	2.2 "
4	1.9 "	1.8 "
5	1.8 "	1.8 "
Average	2.1 "	2.0 "

Cyclic rate of BAR with Sieg Compensator-571 rounds per minute.

Cyclic rate of Standard BAR---600 rounds per minute.

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Test No. 2

a. Purpose: To determine the amount of flash caused by the Sieg Compensator on a BAR.

b. Method: A BAR with the subject compensator and flash hider, a standard BAR, and a standard BAR less flash hider were all fired at night at the normal (fast) cyclic rate.

c. Results:

(1) The BAR with the subject compensator produced the most flash not only at the muzzle but at the compensator. The muzzle flash was visible 100 yards on either side of the firing point. (See figures 7, 8, and 9 of Inclosure No. 5)

(2) The standard BAR without flash hider produced more muzzle flash than the standard BAR with flash hider, but neither was as noticeable in this test as the BAR with the subject compensator.

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Test No. 3

a. Purpose: To determine the comparative amount and distribution of the muzzle blast and smoke resulting from BAR's fired with and without the subject compensator.

b. Method: Observations were made throughout the test firing as to comparative amount and distribution of the muzzle blast and smoke resulting from BAR's fired with and without the subject compensator.

c. Results:

(1) The amount of muzzle blast from a BAR with the subject compensator and a standard BAR was about the same.

(2) Some of the muzzle blast on the BAR with compensator was distributed perpendicularly above the plane of the compensator, whereas the blast of the standard BAR was in front of the muzzle.

(3) The smoke from the BAR with compensator and the standard BAR obscured the target in many cases. The compensator allowed the gases to escape through the top slots which were to the immediate rear of the front sight. The escaping smoke partially obscurred the front sight particularly in automatic firing.

(4) There was no considerable difference in the dust clouds formed by the muzzle blast of the two weapons.

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Test No. 4

a. Purpose: To determine the comparative difference in report noise made by a BAR equipped with Sieg Compensator and a standard BAR.

b. Method: Two men were placed ten yards from a firing point; two more men were placed two hundred yards away, and two additional men were placed five hundred yards away. A BAR with Sieg Compensator was fired several times and then a standard BAR was fired. The personnel were questioned as to which BAR made the loudest noise when fired.

c. Results: All personnel stated that they could tell no difference in the amount of noise made by the two BAR's fired.

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Test No. 5

a. Purpose: To determine the effect of the subject compensator on the accuracy and stability of the gun fired in prescribed position.

b. Method: Three qualified auto-riflemen were used to fire a BAR equipped with the subject compensator and a standard BAR. Each man fired ten (10) rounds with each rifle for each position and rate of fire as follows:

1000"	Single Shot	Prone, kneeling, sitting
1000"	Normal (fast)	Prone
200 yds.	Single Shot	Prone, kneeling, sitting
200 yds.	Normal (fast)	Prone
300 yds.	Single Shot	Prone
300 yds.	Normal (fast)	Prone

Slow automatic fire was not used as the BAR with compensator was not designed to fire this rate.

Vertical and horizontal dimensions of the 80% zone and maximum dispersion were measured and averaged on each 10-round group.

c. Results:

(1) The shot groups varied very little when fired single shot from the prone position. In firing bursts at the normal (fast) cyclic rate, the BAR equipped with the subject compensator appeared to have the better stability as it gave smaller shot groups than did the standard BAR. During single shots in the sitting and kneeling positions, the standard BAR generally gave better groups than the BAR with the subject compensator; it is believed that the cause of this was that the standard BAR had the M1941 sight whereas the BAR with compensator had the old type sights that were more difficult to align in the kneeling and sitting position, which were not as steady than the prone position using the bipod

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(2) Following are the tabulated measurements: Average of 3 men each firing 10 rounds with each gun under the conditions listed below:

Position	Range	Type of Fire	Average Measurements of Shot Groups (in.) 30% Zone Horizontal BAR with Comp.	30% Zone Horizontal BAR w/o Comp.	30% Zone Vertical BAR with Comp.	30% Zone Vertical BAR w/o Comp.	100% Zone Maximum BAR with Comp.	100% Zone Maximum BAR w/o Comp.
Prone	1000"	Single shot - 10 rds.	1.3	1.2	1.1	1.4	2.6	3.0
Kneeling	1000"	Single shot - 10 rds.	2.2	1.8	2.3	2.1	5.0	4.8
Sitting	1000"	Single shot - 10 rds.	3.2	2.9	2.4	2.2	5.8	5.5
Prone	1000"	Normal - 10 rd. burst	1.1	2.6	1.7	3.1	2.7	6.3
Prone	200 yds.	Single shot - 10 rds.	6.6	6.7	7.6	9.3	12.8	19.7
Kneeling	200 yds.	Single shot - 10 rds.	14.5	15.0	17.5	17.3	32.6	33.2
Sitting	200 yds.	Single shot - 10 rds.	14.0	13.9	16.0	16.3	25.2	26.6
Prone	200 yds.	Normal - 10 rd. burst	8.8	11.3	6.6	10.7	15.0	21.3
Prone	300 yds.	Single shot - 10 rds.	10.6	10.8	8.5	10.8	17.0	19.4
Prone	300 yds.	Normal - 10 rd. burst	12.0	21.7	9.8	13.5	18.7	35.6

Test No. 6

a. Purpose: To determine the effect of the compensator on functioning of the rifle.

b. Method: The effect of the compensator on functioning of the rifle was noted throughout the test period.

c. Results: The subject compensator had no apparent effect on the functioning of the rifle during the firing of 1035 rounds. The compensator could not be removed until the tests were completed, which prevented the cleaning of the gas piston and cylinder. For this reason it was necessary to use the largest gas port to keep the weapon operating.

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Test No. 7

a. Purpose: To determine the ease of cleaning, durability, adaptability to the bipod, and recoil effect of the subject compensator on a BAR.

b. Method: Observations on the above were made throughout the test period.

c. Results:

(1) Ease of cleaning.

Upon receipt of the BAR with the Sieg Compensator repeated attempts were made to remove the compensator from the weapon. It was believed that the amount of force necessary to remove it might damage the compensator permanently, therefore, it was decided to complete the tests and then remove the compensator. During this time it was not possible to clean the gas cylinder and piston as the bottom of the compensator jacket prevented their removal. For this reason, the compensator does not permit ready cleaning of the gas cylinder and piston.

(2) Durability

When the compensator was removed it was found that a portion of one ring on the sleeve had broken off. (See Figures 5 of Inclosure 5) The number of rounds fired previously with the weapon and compensator was not made available. The number of rounds fired during the test period of this report was 1035 rounds.

The other components of the compensator appeared to be durable.

(3) Adaptability of the bipod.

The compensator had no effect as far as using the bipod was concerned, as the location of the compensator was in rear of the front sight, whereas the bipod was located in a position forward of the front sight.

(4) Recoil effect.

The compensator reduced the amount of recoil [illegible] on the firer's shoulder. A BAR with the compensator had a slight jump when fired but not the pounding effect given by a BAR without the compensator. All men firing the weapon with the compensator stated the weapon had much less recoil than the weapon without the compensator.

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Inclosure No. 4 - Deficiencies and Modifications.

a. Deficiencies:

In Test No. 7 it was noted that the compensator could not be removed without extreme difficulty. This prevented ready cleaning of the compensator and the gas cylinder and piston. (See Figures 5 and 6 of Inclosure 5)

b. Modifications:

It is believed that the bottom portion of the split-ring sleeve and the bottom portion of the jacket could be constructed with a flatter surface which would then permit easy removal of the gas cylinder and piston for cleaning.

A more suitable method of removing the compensator would enable the user to keep it clean, as once carbon is allowed to form in a large quantity inside the present compensator, it freezes the jacket to the split-ring sleeve.

ROBERT P. BROWN
Capt., Infantry
Test Officer

I concur in the above record of test:

EDWARD B. CROSSMAN
Lt. Col. Infantry
Test Section Executive

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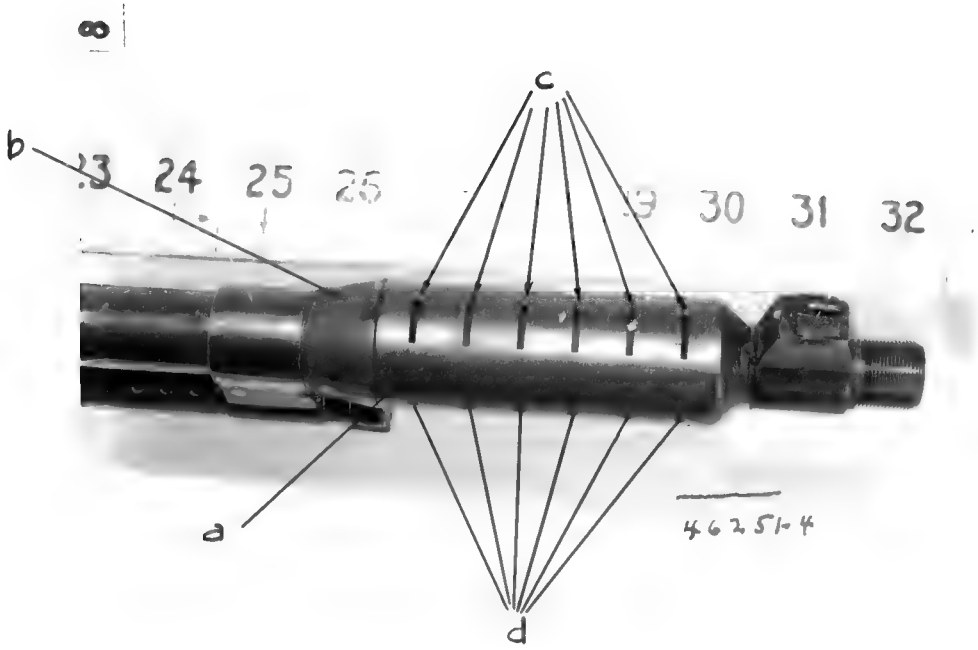

Top view of Sieg Compensator on BAR.

a. Jacket.
b. Rear Collar.
c. Slots.
d. Holes.

Figure 1

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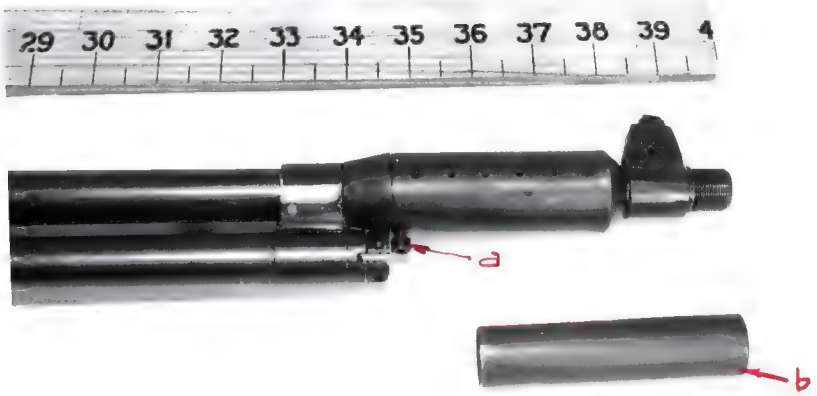

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Side view of Sieg Compensator on BAR with Flash hider Removed.
a. Set screw.
b. Flash hider.

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Side view of Sieg Compensator on Standard BAR.

Figure 3

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View of Standard BAR.

Figure 4

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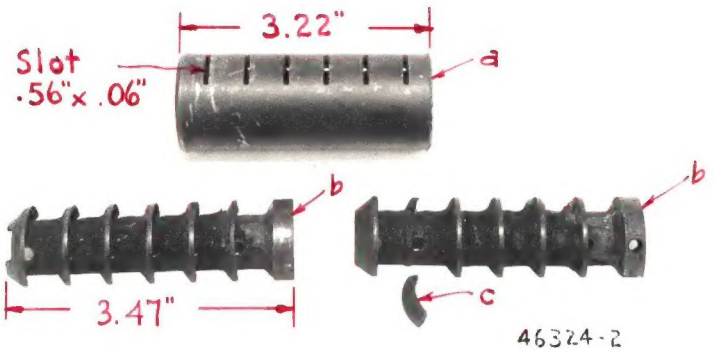

Compensator Less Rear Collar.

a. Jacket.
b. Split-Ring Sleeve.
c. Portion of ring broken from sleeve.

Note carbon formed around rings.

Figure 5

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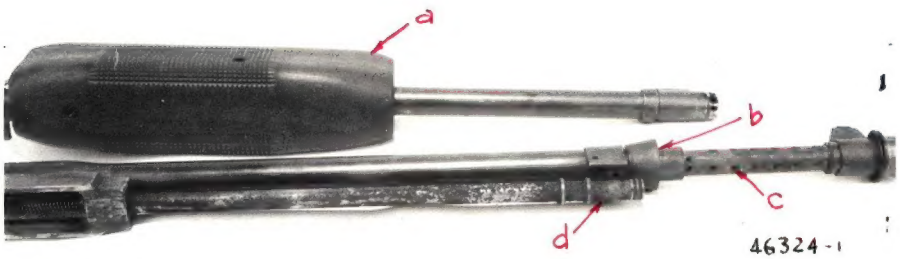

Condition of rifle after test period.

a. Gas cylinder and forearm.
b. Rear collar of compensator.
c. Escape holes in rifle.
d. Gas piston (Note carbon formed)

Figure 6